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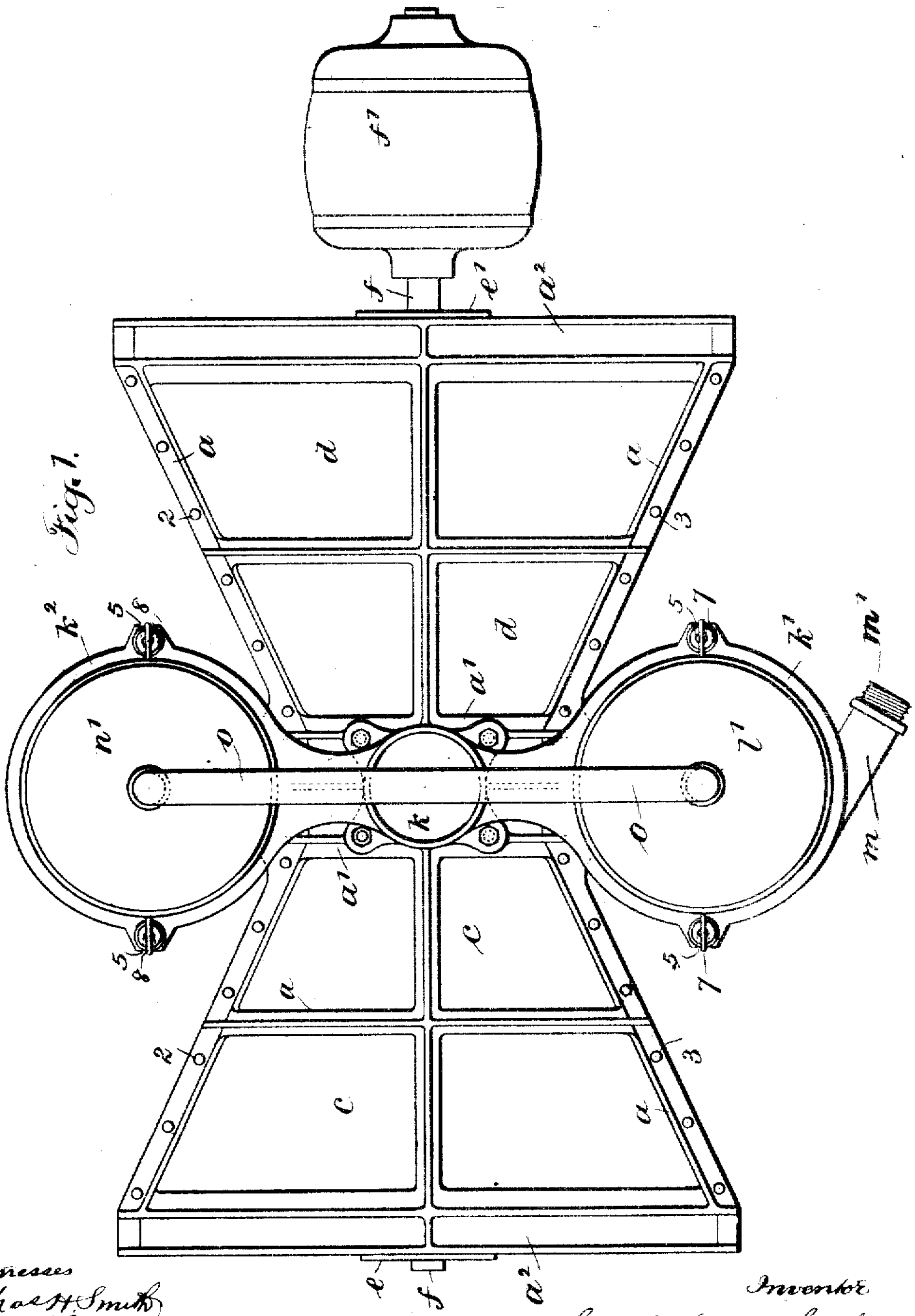
APPLICATION FILED AUG. 1, 1908.

950,495.

Patented Mar. 1, 1910.

3 SHEETS—SHEET 1.



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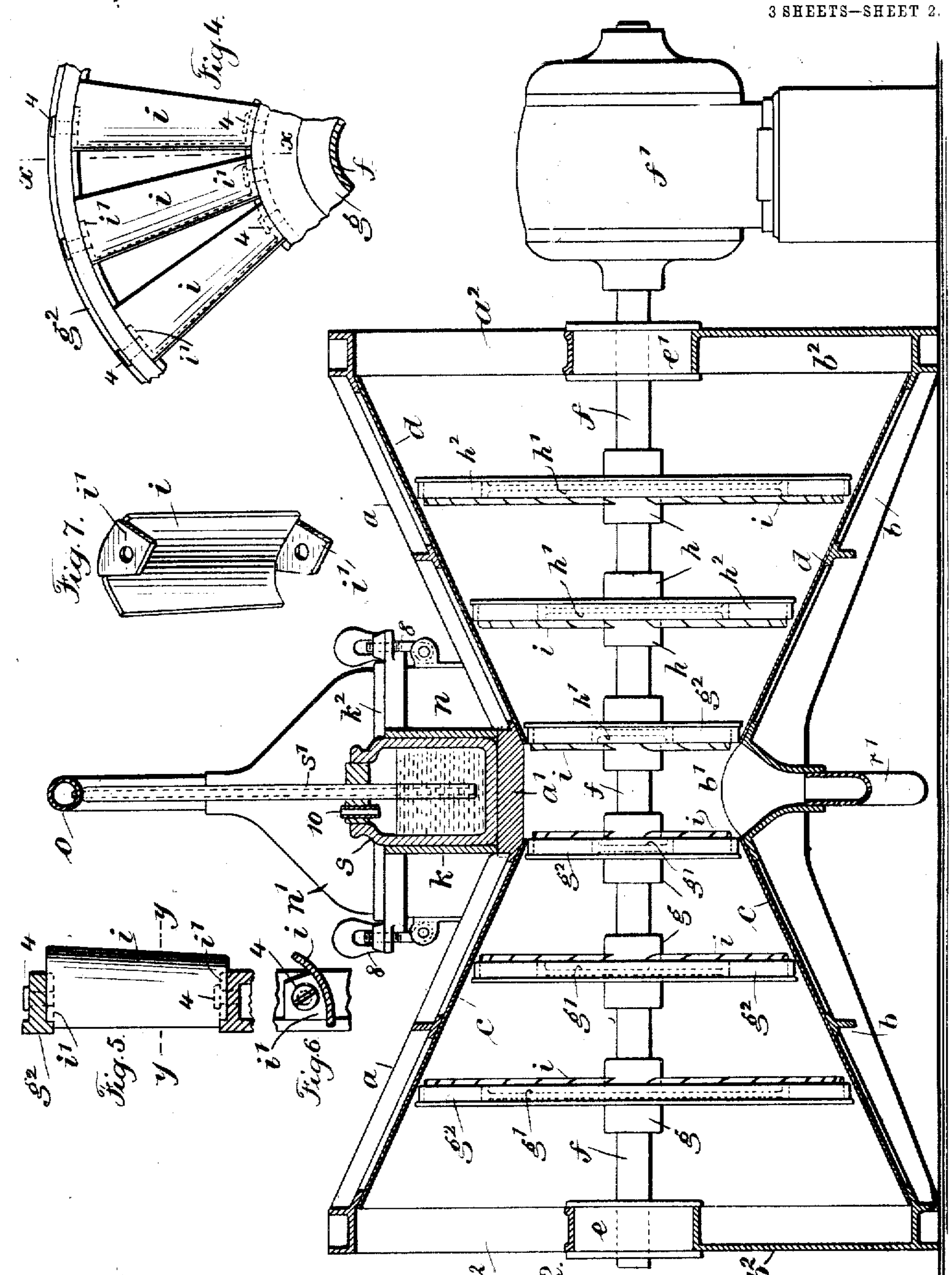

Fig. 2.

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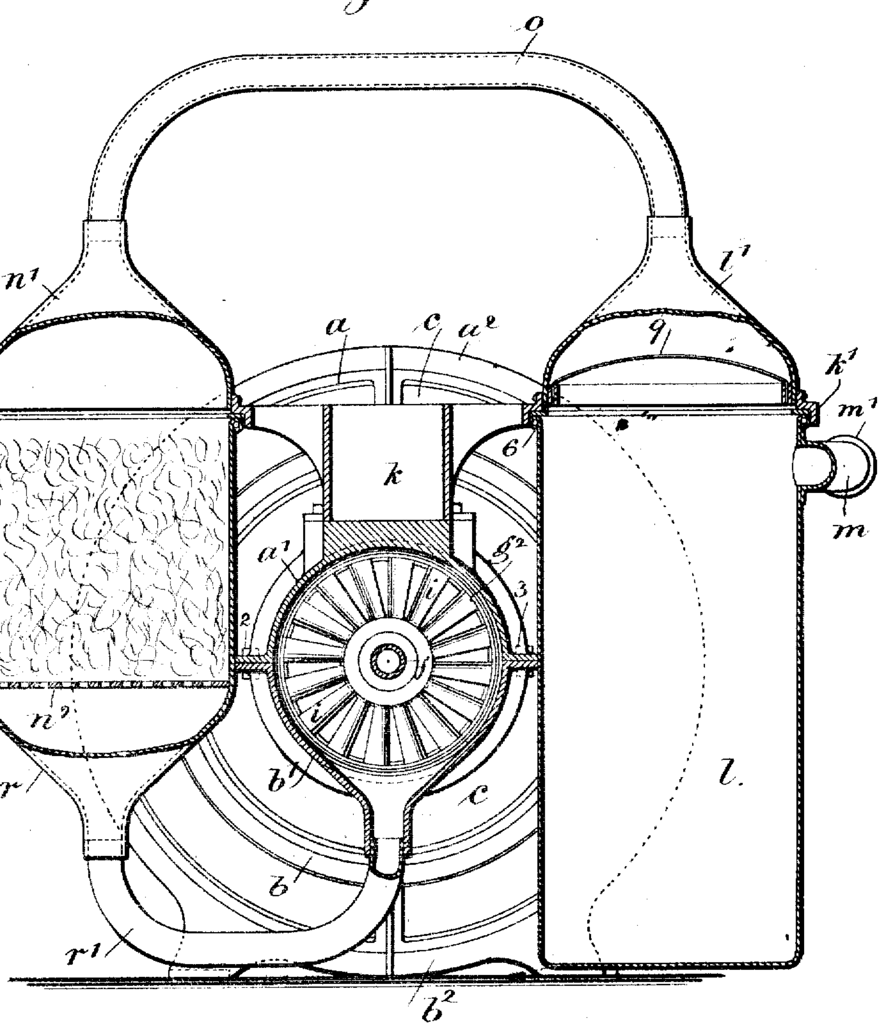
Fig. 3.



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UNITED STATES PATENT OFFICE.

LEMUEL WILLIAM SERRELL, OF PLAINFIELD, NEW JERSEY.

VACUUM-PRODUCING APPARATUS.

950,495. Specification of Letters Patent. **Patented Mar. 1, 1910.**

Application filed August 1, 1908. Serial No. 446,390.

To all whom it may concern:

Be it known that I, LEMUEL WILLIAM SERRELL, a citizen of the United States, residing at Plainfield, in the county of Union and State of New Jersey, have invented an Improvement in Vacuum-Producing Apparatus, of which the following is a specification.

My invention relates to vacuum producing apparatus for cleaning devices, especially those adapted for domestic use. A device occupying a small area and portable; one which can be run by electricity by a connection with the usual house circuits and one in which the turbine form of construction is employed, the object of my invention being the production of a relatively inexpensive apparatus of high efficiency and nominal weight and cost of maintenance.

My invention consists of a flaring or conical hood, inside of which any desired number of said suction fans may be placed and operated to exhaust or suck the dust laden air through a suitable dust separator made part of said machine and placed between the usual form of dust collecting devices with flexible hose attachment and the flaring or conical hood in which said fans are operated.

It has been found from tests made using a suction or exhaust fan placed at the smaller opening of a flaring hood or cone and discharging the exhaust air into said cone, that the suction effort is increased by an amount practically equal to the theoretical difference in the velocity of the air with which it leaves the fan and its velocity where it discharges from the flaring hood into the atmosphere. To illustrate:—suppose the opening in said cone where the air discharges into the atmosphere is four times the area of the fan itself, the suction effort would be increased and would be practically four times greater than were the discharge made into the atmosphere direct without the use of the flaring nozzle.

The speed of moving air is measured by its so called velocity head and in order to produce the greatest amount of suction, the velocity of the moving air must not be retarded, except by gradually expanding the air in such a way that as the velocity head decreases the static head likewise decreases, preserving the established vacuum; thus a right angle bend in a pipe will reduce the velocity head as will also a sudden discharge from a small pipe into a large pipe, but if a cone is placed between the small pipe and the large pipe, the air will expand gradually and its forward velocity will diminish inversely as the area of the cone or pipe increases and the static head is decreased in the same proportion, thus preserving the vacuum already established. In the design of this apparatus all pipe bends are made of large radius and flaring cones are placed between all pipes or vessels having different diameters, so that the velocity heads and static heads may not be mechanically interfered with and the vacuum established may be preserved.

In the carrying out of my invention, I prefer to use two oppositely placed conical hoods, the smaller ends of which come into proximity in the form of an hour glass with a small central chamber between them. In this hour glass or double conical case and upon an axial shaft thereof are placed oppositely disposed a series of impellers of progressively increasing diameters, the revolution of which exhausts or sucks the dust laden air through a dust separator, where the dust is arrested and the air passes on to the central chamber between the two conical hoods. A very high velocity is attained by these impellers which are fan-wheels of peculiar form and because of the increasing diameters of said parts toward the delivery end, the air as delivered is expanded, its volume increased and its momentum thereby diminished.

While the machine can be built and operated with one conical hood, I prefer to make use of two, as it makes possible the use of double inlet suction devices or fans balanced against each other, which will take in the same amount of air as a single inlet fan at double the speed of suction.

In operation, the air initially drawn through the inlet fan, is discharged into the flaring cone in the space between the inlet fan and the next fan on the shaft. The velocity of the air is diminished in proportion to the relative areas of the cone at the first and second fans. This air is gathered up by the second fan, which is larger and more powerful than the first fan, and is sent forward into the space between the first and second fans where the third fan, being larger and more powerful than the second fan, sends it again forward. This process can be continued at will until the air is finally discharged through the end of the cone into the atmosphere.

In the drawing, Figure 1 is a top plan view of my improved portable vacuum cleaning apparatus. Fig. 2 is a longitudinal central section and partial elevation of the same. Fig. 3 is a central cross section and partial elevation. Fig. 4 is a partial elevation of one of the fan-wheels. Fig. 5 is a vertical section at the dotted line x, x, of Fig. 4. Fig. 6 is a sectional plan at the dotted line y, y, of Fig. 5, and Fig. 7 is a perspective view of one of the blades of the turbine structure.

The turbine device consists of a conical skeleton frame in two parts divided along a horizontal plane. These two parts are represented at a b with integral central frame parts a^1 b^1 and frame ends a^2 b^2; the frame ends having foot pieces shown in Fig. 3 providing for the support of the case, inside of which are the sheet metal cones c d set in opposition fitting snugly within the frames with the smaller ends coming against the central frame parts a^1 b^1. The conical skeleton frames divided along a horizontal line are securely connected by bolts 2 3 and the internal sheet metal cones may be held frictionally in position or may be otherwise secured in any desired manner.

Centrally in the frame ends a^2 b^2 are bearings e e^1 preferably supported by radial support arms which however, are not shown except generally in Fig. 2. A shaft f in these bearings e e^1 passes centrally and axially through the hour glass structure or double conical frame members, and on one end of this shaft is a motor f^1 of suitable character directly connected to the shaft for revolving the same and the parts carried thereby. This motor may be electrically connected to the regular light service of a private dwelling for its operation. Upon this shaft f and at spaced apart intervals are hubs g and h in series at each side of the center and disks g^1 h^1 are formed with these hubs, and I provide rims g^2 h^2 shown in series at each side of the center and between the respective disks and rims are fixed and secured the turbine blades i, details of which are particularly shown in Figs. 4 to 7 inclusive. Each of these turbine blades is alike and as shown in Fig. 7, consists of the curved blade i with flanges i^1 at the opposite edges which are perforated for securing devices such as the screws 4, one flange being connected to the rim of the disk forming part of one of said hubs and the other flange to an outside rim; the blades serving to connect the rims with the disks so that each built up structure comprises a hub, with its disk and rim, curved blades and an outside rim and constitutes one of the turbine devices. These turbine devices are all alike but of progressively increasing size, except that in the series at the right hand side of the center Fig. 2, the blades are set in the opposite direction to what they are set at the left hand side of the center Fig. 2. While I have herein shown and described a series of disks g^1 h^1 in connection with these turbine devices or impellers, I do not limit myself to the precise details of the impeller devices so long as the same and the inclosing case are of conoidal form or gradually increasing diameters.

The upper portion of the central frame a' is made flat, and resting thereon and secured thereto as will appear particularly from Figs. 2 and 3, is a frame k placed transversely in its line of direction of the axis of the hour glass structure. This frame is provided with an open center and with ring ends k^1 k^2 which are flanged in cross section as will appear particularly from Fig. 3. These ring ends have projections at opposite sides provided with notches 5.

I provide two receptacles or vessels l n. These vessels are formed with beaded upper edges 6 which are of a diameter to be snugly received into the lower flange of the rear-ends k^1 k^2 and therein to set against packing rings, and these vessels l n at opposite sides are provided with clamping means 7 8 each of which consists of lugs secured to the outer surface of the vessel, a screw stem pivoted in the lugs and a nut on the screw stem, and the screw stems are received in the notches 5 and the nuts are employed to apply tension in securing the vessels to the ring-ends and providing air tight connections with the same by means of said intervening packing rings. The vessel l is a dry gravity dust separator. It is provided with an inlet pipe m to receive the dust ladened air to which inlet pipe m a hose of usual construction is to be secured at the coupling end m^1, see Fig. 1; said hose at its free end having connected to it any one of the usual appliances employed for vacuum cleaning purposes. These vessels l n are each provided with conical hoods l^1 n^1 whose bases are securely fastened to the upper flanges of the ring-ends k^1 k^2; said conical hoods being connected by an arched pipe o. In the conical hood l^1 I provide a diaphragm 9 suitably secured in place and preferably secured between rings or annuli fastened to the inner surface of the larger end of the hood. This diaphragm is preferably of fabric through which the air may pass and of such a mesh as to prevent the dust passing through it. The vessel n is advantageously provided with a perforated metal diaphragm n^2 in the lower portion, and I prefer to fill this vessel n with excelsior which is preferably moistened with water or oil. The lower end of the vessel n is provided with a conical hood r from the small end of which the pipe r^1 extends to the lower portion of the central frame part b^1, which as will appear from Fig. 2, is centrally contracted to receive the opposite end of this pipe r^1.

In the open central portion of the frame k, I prefer to place a vessel or bottle s for water, with a pipe s^1 passing through the stopper of said vessel down into the liquid therein, and the upper end of the pipe tapered and passed into the center of the pipe o, and I also prefer to employ through the stopper of this vessel s a pipe 10 for air to replace the liquid of said vessel as the same is drawn out in the operation of the machine.

In the operation of the device of my improvement, the rotation by the motor f^1 on the shaft f and the turbine devices in the conical hour glass structure creates a vacuum to a greater or less extent at the central portion of the hour glass structure; in the pipe r^1, hood r, vessel n, hood n^1, pipe o, hood l^1, vessel l, inlet pipe m and the hose extending therefrom to the vacuum cleaning devices. This vacuum causes the dust laden air to be drawn through the cleaning devices and by the inlet pipe m into the receptacle l, in which the greater portion of the dust settles; the air passing through the diaphragm 9 through the hood l^1, pipe o, hood n^1 into the vessel n. This movement of the air creates a vacuum in the tube s^1 drawing up a minute quantity of the liquid through said tube s^1 and discharging the same as a vapor into the pipe o with the passage therethrough of the air which may contain a small quantity of very fine dust, the dust thereby being moistened, and as the same passes on into the vessel n, the moistened excelsior takes up and takes out of the air other particles of the dust, the same being deposited upon the excelsior filling of the vessel. The diaphragm n^2 of this vessel acts more as a support for the filling material. The air freed of all dust passes through this diaphragm, through the hood r and pipe r^1 into the center chamber of the hour glass vacuum producing structure and said air is delivered in opposite directions through the larger ends of the said hour glass structure into the atmosphere, passing first through the smaller of the fan devices, then expanding into the increased area, then passing through the second of the fan devices and expanding into the greater area and then passing through the larger of said devices and still expanding into the increased area and being delivered into the atmosphere. This progressive expansion of the air decreases both its velocity and static pressure between each pair of suction fans, thereby increasing the vacuum produced, while decreasing the velocity and pressure at which the air is finally delivered into the atmosphere. The speed at which the fan devices are run is the measure of the vacuum produced in the apparatus to a great extent.

I do not limit myself to the style or form of the fan devices employed or to the size or number of blades employed therewith, or to the number of fan devices employed alone or in series at opposite sides of the center, nor to the relative size of the hour glass construction.

The vessels l and n as shown and hereinbefore described, are connected to and supported from the transverse frame k, and in this connection air tight joints are formed with the packings that intervene, consequently these vessels are both removable and it is essential that they should be removable for the reason that the vessel l receives and holds almost all the dust that is collected and consequently requires that the collected dust should be occasionally removed and the vessel cleansed. The moistened excelsior or other material in the vessel n also requires to be occasionally replenished so as to most effectually perform the functions thereof, and to facilitate the removal of the vessel n, I prefer to employ a piece of rubber hose for the pipe r^1 as the same provides the flexibility necessary. It will hardly be necessary to make the hoods l^1 n^1 and the pipe r^1 removable because the smaller areas thereof are kept cleansed by the rapid motion therethrough of the air.

I prefer to make the curved blades i and their integral flanges i^1 of aluminum or similar tough light weight metal, for thereby the weight of the revoluble member is lessened and in lessening the weight the power required to operate it is of course decreased, and I may construct the entire machine or any part or parts thereof of aluminum or light weight metal as desired and I also to advantage may place the machine and its motor on a wheeled platform so that it may readily be moved about.

I claim as my invention:

1. A vacuum producing apparatus comprising spaced impellers of gradually increasing diameters, a case also of gradually increasing diameter extending around the impellers, and a suction inlet at the smaller part of the case through which air is drawn into the case and expands toward and is delivered from the larger end of the case.

2. A vacuum producing apparatus comprising spaced impellers of gradually increasing diameters, a case therefor of increasing diameter and open to the atmosphere at the delivery and largest end, and a suction inlet at the opposite and smallest end of the case.

3. A vacuum producing apparatus comprising spaced impellers in series of progressively increasing diameters, a conical case

adapted to extend around the series of impellers and also of progressively increasing diameters, an inlet for air into the case at the smaller end, and the air moving through the case toward the larger end from which it is expelled and expanded in transit between each of the series of spaced impellers.

4. In a vacuum producing apparatus, a case of gradually increasing diameter transversely of the axis, open to the atmosphere at one end, and an inclosed inlet for air into the case at the other and smaller end, a series of spaced impellers of gradually increasing diameters surrounded by the case, a shaft therefor placed axially of the case and the impelling devices of the impellers upon the faces thereof toward the smaller end of the case so as to draw the air from the smaller end and force it along toward the larger and delivery end of the case to be expanded in transit.

5. A vacuum producing apparatus comprising spaced impellers of gradually increasing diameters, an inclosing case therefor agreeing in diameter with said spaced impellers contiguous to their peripheries and of increasing diameter on the delivery side of each impeller and into which the air as delivered expands, and a suction inlet at the smaller part of the case through which air is drawn into the case and is progressively expanded and delivered from the larger end.

6. A vacuum producing apparatus comprising two oppositely disposed series of spaced impellers of progressively increasing diameters for effecting the vacuum, conical inclosing cases therefor also set in opposition with the smaller ends adjacent, said case being also of gradually increasing diameters extending around the impellers, and a suction inlet between the series of impellers at the smaller part of the case through which the air is drawn toward the respective larger and delivery ends of the case expanding in transit.

7. In a vacuum producing apparatus, the combination with a double conical or hourglass case, a suction inlet in the center and smaller part of the case through which air is drawn into the case, a shaft passing axially through the hour-glass case, series of spaced impellers of gradually increasing diameters mounted on said shaft in said case and means for revolving the same.

8. In a vacuum producing apparatus, a conical skeleton frame structure divided centrally along a horizontal line, internal sheet metal cones within said skeleton frame, a central shaft passing axially through said structure, spaced impellers of gradually increasing diameters mounted upon said shaft, and means for actuating the same, and a suction inlet at the smaller part of the case through which air is drawn into the case.

9. In a vacuum producing apparatus, a revoluble vacuum producer, consisting of spaced revoluble devices in series, each revoluble device consisting of an imperforate center and peripheral impellers, the revoluble devices being of gradually increasing diameters, a shaft on which the same are mounted, a case also of gradually increasing diameter extending around the revoluble devices, a suction inlet at the smaller end of the case through which air is drawn into the case and is directed through the case and delivered from the larger end, the air in transit expanding between the respective revoluble devices.

Signed by me this 23d day of July 1908.

LEMUEL WILLIAM SERRELL.

Witnesses:
GEO. T. PINCKNEY,
BERTHA M. ALLEN.